EFFECT OF *PSEUDOMYRMEX SPINICOLA* VERSUS *P. FLAVICORNIS* ON *ACACIA COLLINSII* CONDITION

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Abstract. (JMH) We predicted that different colonizing ant species inhabiting *Acacia collinsii* would have different effects on tree condition, as measured by leaf number. We found no significant difference in leaf number between trees colonized by *Pseudomyrmex spinicola* and trees colonized by *P. flavicornis*. Our data imply that the two species of ants perform equally well in defending their host tree, at least as indicated by leaf number.

INTRODUCTION (JMH)

The ant-acacia tree is a mutualistic host to several species of ants. By definition, mutualisms benefit both participant species. *Acacia collinsii* provides the ants with large thorns in which to live and comprehensive food resources including liquid nutrients via extra-foliar nectaries, fat, and protein in the form of Beltian bodies. Like that of many tropical tree species, *A. collinsii* 's growth is limited by both herbivorous insects and competition with neighboring vegetation. It is these limitations that mutualistic ants seem to reduce.

The potential species of ant colonizers all exhibit different behaviors. For example, the common red ant, *Pseudomyrmex spinicola*, is very aggressive in its attack on herbivores that come into contact with the host tree and in its removal of foreign plants around the host tree (Wray et al. 1995). The common black ant, *P. flavicornis*, is less aggressive (Janzen 1983). Although the ant-acacia would benefit from having a colony of either of these ant species, we hypothesized that *A. collinsi* trees would benefit more from having a *P. spinicola* colony than a *P. flavicornis* colony. This assumes that *P. spinicola* is more effective in eliminating the two major sources of growth interference: competing vegetation and insect herbivory. Therefore, we predicted that the ant-acacia trees colonized by *P. spinicola* would be in better condition than those with *P. flavicornis* colonies. We used the number of leaves as an index to condition

METHODS (SDK)

We searched for *A. collinsii* on a belt transect along the Senedero Venada at Palo Verde National Wildlife Refuge, Costa Rica. The transect began 25 paces in from the main road, and the belt extended for 10 m on either side of the trail for about 200 m.

Because *P. flavicornis* is less common (pers. obs.), we first searched for *A. collinsii* trees 0.5 - 4 m tall colonized by *P. flavicornis*. We then located the nearest neighboring *A. collinsii* of similar height (actual maximum difference was 8.1%) colonized by *P. spinicola*. The maximum distance between the paired trees was 10 m. Trees that were within the size criteria but did not have a possible paired *P. spinicola* colonized tree within the same micro habitat were excluded. The total number of leaves on 12 pairs of *A. collinsii* trees were counted.

RESULTS (CDC)

Among the *A. collinsii* pairs, trees defended by *P. spinicola* had an average of 31% more leaves (± SE of 24%) than trees defended by *P. flavicornis*. The mean difference between the pairs was 44.4 leaves (± SE of 43.0). This trend, however, was not significant (paired t-test: t=1.033, df=11, P=0.32).

The trees sampled ranged in height from small seedlings (0.4 m high), to large saplings (4.0 m high). To take into account these differences in plant size, leaf number is therefore presented as leaves per m of tree height (Table 1). The mean difference

in height between the paired trees was only 16 cm (±SE of 40), and thus did not appear to present a significant source of bias in a paired comparison.

TABLE 1. Differences in leaf number (adjusted by height) between paired *A. collinsii* trees defended by *P. spinicola* and by *P. flavicornis* (n=12 pairs).

	P. spinicola	*P. flavicornus*
mean number/ m height (±SE)	101.6 (± 13.8)	89.8 (± 9.8)

DISCUSSION (JHB AND AVB)

We found no difference in *A. collinsii* condition, as measured by leaf number, between individuals colonized by *P. spinicola* and individuals colonized by *P. flavicornis*. This suggests that the two ant species perform equally well in defending their host trees.

Leaf number, however, may not be a good indicator of tree condition. Other potential indices of tree condition might include individual leaf condition or new stem growth because these may better represent physiological condition and be less dependent on tree size. Furthermore, we may not have been able to detect a true significant difference between *P. spinicola* and *P. flavicornis* acacias because of limited sample size. Our sample of leaf number differences had a standard error approximately equal to the mean. A larger sample size might control for variation in leaf number due to the many other factors affecting tree condition such as light, competition and nutrients. Also, because we choose the trees colonized by *P. flavicornis* first, then found corresponding trees colonized by *P. spinicola*, we may have biased our samples towards habitats that were more favorable for trees that are colonized by *P. flavicornis*.

Future studies should focus on identifying potential benefits to the *A. collinsii* of different species of colonizing ants, as well as on identifying accurate indicators of *A. collinsii* condition. Host defense by a particular ant species may enable the plant to conserve some of its own energy. Thus, the effect of the colonizing ant species might be observed in increased reproductive output, as the plant can allocate more energy into reproduction, rather than into just growth or maintenance of condition.

There are also possible explanations for the difference in abundance of the two ant species that could profitably be investigated in the future. If the colonization by either species has the same effect on plant condition, *P. spincola* might be out competing *P. flavicornis* in some other aspect, such as higher rates of reproduction or ability to colonize acacias trees earlier. If it is confirmed that there is no difference in the effect of *P. flavicornis* and *P. spinicola* on plant condition, research will need to address other possible explanations for the differential colonization of *A. collinsii* by the two ant species.

LITERATURE CITED

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